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# Assessment of Manufacturers Capability to Meet Requirements for Particulate Controls on Utility and Industrial Boilers

Industrial Gas Cleaning Inst, Inc, Stamford, CT

Prepared for

Environmental Protection Agency, Research Triangle Park, NC

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# ASSESSMENT OF MANUFACTURERS CAPABILITY TO MEET REQUIREMENTS FOR PARTICULATE CONTROLS ON UTILITY AND INDUSTRIAL BOILERS

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A survey of manufacturers of particulate control equipment was conducted to determine the industry's capability to meet the demand for control equipment required by a change in particulate emission standards for utility and industrial boilers. The report details the numbers and sizes of fabric filters and electrostatic precipitators that can be designed and installed in the 1978-1982, 1983-1987, 1988-1992 time spans. Attention was also given to factors which might prove to be bottlenecks.

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# ASSESSMENT OF MANUFACTURERS CAPABILITY TO MEET REQUIREMENTS FOR PARTICULATE CONTROLS ON UTILITY AND INDUSTRIAL BOILERS

Prepared by

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# 1.0 INTRODUCTION

To comply with air pollution regulations an adequate supply of air pollution abatement equipment must be available. The Industrial Gas Cleaning Institute (IGCI) under contract to the U.S. Environmental Protection Agency, conducted a survey of equipment manufacturers to determine their ability to supply fabric filters and electrostatic precipitators (ESP's) for use on utility and industrial boilers.

A survey form was sent to 25 fabric filter manufacturers and 18 ESP manufacturers. Information was requested from each manufacturer on the following subjects:

- Applicability of fabric filters or ESP's to boiler type and size range for coal-fired units.
- Guarantees.
- Their capability to design and install various sizes of fabric filters and ESP's.
- Factors which may delay the design, construction, or start-up of fabric filters and ESP's.
- Ways of reducing delay-related problems.

This report summarizes the results of the survey. Table 1-1 lists the manufacturers responding to the survey and the types of particulate control system offered. The

Table 1-1. MANUFACTURERS RESPONDING TO THE SURVEY AND TYPE OF PARTICULATE CONTROL SYSTEM OFFERED BY EACH

| Manufacturer | Type of control system offered | |
|---|---|---|
| | Fabric filter | Electrostatic precipitator |
| 1. Air Correction Division - UOP, Inc. | | X |
| 2. American Air Filter Company, Inc. | X | X |
| 3. Apitron Division - American Precision Industries, Inc. | X | |
| 4. Babcock & Wilcox Company | | X |
| 5. Belco Pollution Control Corporation | X | |
| 6. Buffalo Forge Company | X | |
| 7. Carborundum Environmental Systems, Inc. | | X |
| 8. The Ceilcote Company | X | |
| 9. C-E Air Preheater Company | X | X |
| 10. C-E Walther, Inc. | X | X |
| 11. Environmental Elements Corporation | X | X |
| 12. Envirotech-Buell Emission Control Division | X | X |
| 13. Flakt, Inc. | X | |
| 14. Fuller Company | X | |
| 15. Industrial Clean Air, Inc. | X | X |
| 16. Joy Manufacturing Company Western Precipitation Division | X | |
| 17. Lear Siegler, Inc. | X | X |
| 18. MikroPul Corporation | X | X |
| 19. Peabody Air Resources Equipment Company | X | X |
| 20. Research-Cottrell, Inc. | X | |
| 21. Standard Havens, Inc. | X | X |
| 22. Wheelabrator-Frye, Inc. | X | |
| 23. Zurn Industries, Inc. | | |

overall response rate from the survey was 77 percent. The majority of the non-responding companies do not manufacture the equipment at the present time.

## 2.0 MANUFACTURERS' CAPABILITIES

This section includes a summary of the manufacturer's capability to design and install fabric filter and ESP systems.

Each manufacturer of fabric filters and ESP's was asked to estimate the number of systems the company could design and install over a 15-year period, with current and expanded staff (or by more extensive use of subcontractors). Tables 2-1 and 2-2 summarize the information they provided. The majority of the manufacturers said their equipment can be used on new as well as on retrofit installations.

## Table 2-1. PROJECTED NUMBER OF FABRIC FILTERS THAT MANUFACTURERS CAN DESIGN AND INSTALL OVER A 15-YEAR PERIOD

| Equivalent MW | Number of units designed[a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| | 1978 - 1982 | | 1983 - 1987 | | 1988 - 1992 | |
| | With Present staff | With Expanded staff | With Present staff | With Expanded staff | With Present staff | With Expanded staff |
| 5 MWe[d] | 1512 | 2237 | 1865 | 2402 | 1998 | 2590 |
| 20 MWe[e] | 1249 | 1706 | 1550 | 1785 | 1636 | 1888 |
| 50 MWe[e] | 1008 | 1367 | 1320 | 1449 | 1372 | 1506 |
| 200 MWe[d] | 575 | 749 | 681 | 810 | 706 | 824 |
| 1000 MWe[f] | 300 | 413 | 394 | 440 | 411 | 444 |

| Equivalent MW | Number of units installed[a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| | 1978 - 1982 | | 1983 - 1987 | | 1988 - 1992 | |
| | With Present staff | With Expanded staff | With Present staff | With Expanded staff | With Present staff | With Expanded staff |
| 5 MWe[g] | 1298 | 1899 | 1562 | 1954 | 1618 | 2054 |
| 20 MWe[d] | 1014 | 1378 | 1318 | 1342 | 1334 | 1567 |
| 50 MWe[d] | 830 | 1097 | 1200 | 1315 | 1274 | 1458 |
| 200 MWe[d] | 454 | 600 | 660 | 788 | 656 | 782 |
| 1000 MWe[f] | 243 | 337 | 332 | 366 | 349 | 392 |

[a] The number of units is based on the assumption that the total fabric filter resources of each manufacturer is devoted to designing and installing the designated size.

[b] Quantities shown are for systems which include flange-to-flange equipment.

[c] The difference between the number of systems designed and the number installed is due to the long lead time for system installation.

[d] Represents the responses of 18 manufacturers.

[e] Represents the responses of 19 manufacturers.

[f] Represents the responses of 15 manufacturers.

[g] Represents the responses of 17 manufacturers.

Table 2-2. PROJECTED NUMBER OF ELECTROSTATIC PRECIPITATORS THAT MANUFACTURERS CAN DESIGN AND INSTALL OVER A 15-YEAR PERIOD

| Equivalent MW | Number of units designed[a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| | 1978 - 1982 | | 1983 - 1987 | | 1988 - 1992 | |
| | With Present staff | With Expanded staff | With Present staff | With Expanded staff | With Present staff | With Expanded staff |
| 5 MWe (400 SCA)[d] | 1268 | 1728 | 1340 | 1816 | 1413 | 1918 |
| 20 MWe (400 SCA)[e] | 1097 | 1396 | 1157 | 1474 | 1220 | 1558 |
| 50 MWe (400 SCA)[f] | 856 | 1110 | 913 | 1194 | 971 | 1269 |
| 200 MWe (400 SCA)[g] | 572 | 726 | 620 | 818 | 669 | 881 |
| 1000 MWe (400 SCA)[g] | 333 | 442 | 357 | 499 | 394 | 542 |

| Equivalent MW | Number of units installed[a,b,c] | | | | | |
|---|---|---|---|---|---|---|
| | 1978 - 1982 | | 1983 - 1987 | | 1988 - 1992 | |
| | With Present staff | With Expanded staff | With Present staff | With Expanded staff | With Present staff | With Expanded staff |
| 5 MWe (400 SCA)[d] | 837 | 1196 | 862 | 1237 | 933 | 1293 |
| 20 MWe (400 SCA)[e] | 795 | 1048 | 903 | 1197 | 949 | 1232 |
| 50 MWe (400 SCA)[f] | 660 | 844 | 782 | 1024 | 845 | 1088 |
| 200 MWe (400 SCA)[g] | 522 | 649 | 614 | 799 | 654 | 844 |
| 1000 MWe (400 SCA)[g] | 266 | 347 | 305 | 423 | 355 | 483 |

[a] The number of units is based on the assumption that the total electrostatic precipitator resources of each manufacturer is devoted to designing and installing the designated size.

[b] Quantities shown are for systems which include flange-to-flange equipment.

[c] The difference between the number of systems designed and the numbers installed is due to the long lead time for system installation.

[d] Represents the responses of 9 manufacturers.

[e] Represents the response of 12 manufacturers.

[f] Represents the response of 14 manufacturers.

[g] Represents the responses of 13 manufacturers.

## 3.0 GUARANTEES

Manufacturers were asked to indicate the types of guarantee they offer on fabric filters and ESP's, as well as their conditions and qualifications. Information on guarantees on the following specific items was requested:

- Particulate removal efficiency (or outlet loading)
- Predetermined installation cost
- Performance (availability)
- Other

Tables 3-1 and 3-2 summarize the responses.

## Table 3-1. GUARANTEES OFFERED BY MANUFACTURERS OF FABRIC FILTERS

| Company[a] | Type of guarantee offered/conditions | | | |
|---|---|---|---|---|
| | Particulate outlet emission, gr/scf | Predetermined installation cost | Performance (availability) | Other |
| 1 | 0.01[b] | None | None | Filter cloth life |
| 2 | 0.015,[b] | Fixed price | Yes (conditions not disclosed) | None |
| 3 | 0.01[c] | None | None | 12 months on bag life |
| 4 | 0.02-0.03[b] | None | Only on specific installations | Filter cloth life, |
| 5 | 0.02[b] | Only on turnkey projects | None | Filter cloth life, ΔP |
| 6 | 0.01,[b] compliance with applicable code | Only on turnkey projects | Service and operation contract available | Filter cloth life |
| 7 | 0.02[b] | Subject to escalation clause | 100% when operated as instructed | None |
| 8 | 0.01[b] | Subject to site conditions and schedules | Subject to various clauses | Filter cloth life, 1 to 2 years |
| 9 | 0.003-0.006,[b] compliance with applicable code | Fixed price contract | No | Standard material and workmanship |
| 10 | 0.02,[b] for specific conditions and test methods | Subject to specific conditions | Subject to specific conditions | Filter cloth life |
| 11 | 0.02[b] | Subject to labor rates and conditions of sale | Based on individual application | Extended warrrantiee |
| 12 | 0.001[b] | Subject to escalation clause, unless contract is for rigid time frame | 100% | Bag life, power consumption |
| 13 | 0.02 for 12 months at design conditions | Subject to escalation clause | 12 months at design conditions | Filter cloth life |
| 14 | 0.02-0.03[b] based on EPA test method | Fixed price | None | None |
| 15 | 0.01[b] | Fixed price | Subject to design conditions | ΔP |
| 16 | 0.03[b] | Subject to escalation clause | None | ΔP, temperature |
| 17 | To meet current local and federal codes[b] | Subject to escalation clause | None | ΔP, bag life |
| 18 | None | None | None | None |
| 19 | 0.005[c] | Subject to escalation clause | None | ΔP, temperature, power consumption |
| 20 | 0.01 or less[b] | Subject to specific conditions | Subject to design conditions | Opacity |

[a] Company names are deliberately withheld.

[b] This guarantee is given on new as well as existing units.

[c] This guarantee is given on new units only.

## Table 3-2. GUARANTEES OFFERED BY MANUFACTURERS OF ELECTROSTATIC PRECIPITATORS

| Company[a] | Type of guarantee offered/conditions | | | |
|---|---|---|---|---|
| | Particulate removal efficiency | Predetermined installation cost | Performance (availability) | Other |
| A | Up to 99.9%[b] | Subject to escalation clause | None | None |
| B | Minimum 99% | Subject to government escalation indices | None | ΔP, if required |
| C | 90-99.5%[b] | None | None | Standard workmanship and materials |
| D | 95-99.9%[c]<br>90-99.9%[d] | Firm bids provided | Yes, based on operating parameters | Material and workmanship |
| E | 99.5%[b] | Yes (conditions not disclosed) | None | ΔP, opacity |
| F | 96-99.8%,[b] for 12 months at design conditions | Subject to escalation clause | 12 months at design conditions | Opacity |
| G | Up to 99.9%,[b] with a stopper on outlet emissions | For a specified time period | For a specified time | ΔP, power consumption |
| H | 99.9%[b] | For a specified time period | None | ΔP, power consumption, temperature loss |
| I | 99.99%,[b] with a stopper on outlet emissions | Subject to craft union rates | None | Material and workmanship |
| J | 99.5-99.9%,[b] with specified conditions | Subject to specific conditions | None | None |
| K | 98-99.5%,[b] with an outlet stopper | Subject to escalation clause | 12 months | ΔP |
| L | Up to 99.8%[b] | Subject to escalation clause | None | ΔP, power consumption |
| M | Up to 99.9% with an outlet stopper[b] | Subject to escalation clause | None | ΔP, power consumption, temperature |
| N | Up to 99.9%[b] | Subject to specific conditions | For a specified time | None |

[a] Company names are deliberately withheld.

[b] This guarantee is given on new as well as existing units.

[c] This guarnatee is given on new units only.

[d] This guarantee is given on existing units only.

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# 4.0 LIMITING ITEM ANALYSIS

Numerous factors affect the design and installation schedules of fabric filters and ESP's and may ultimately affect timely completion of a project as well as its cost. The first part of this section summarizes manufacturers' opinions on possible bottlenecks; the latter part identifies corrective actions to overcome delay-related problems.

## 4.1 FACTORS WHICH MAY DELAY THE DESIGN, CONSTRUCTION OR START-UP OF FABRIC FILTERS AND ESP's

Factors cited by manufacturers as contributing to delay in design and installation of the control devices were:

- Availability of qualified personnel
- Component availability
- Coordination between manufacturer, client, and consulting engineers.

Table 4-1 shows the number of respondents within each category.

## 4.2 ITEMS WHICH MAY OVERCOME DELAY-RELATED PROBLEMS

The manufacturers were asked to recommend action that may be taken by a utility, industry, government, and others to overcome delay-related problems. Of 14 manufacturers responding to this question, the following item was cited by four:

Table 4-1. ITEMS WHICH MAY DELAY THE DESIGN, AND INSTALLATION OF FABRIC FILTERS AND ESP's[a]

| | Personnel | Component | Coordination | Other |
|---|---|---|---|---|
| No. of manufacturers responding | 18 | 11 | 5 | ° Government regulations<br>° Material shipment delay<br>° Equipment delays |

[a] Represents the responses of 23 manufacturers. Some companies manufacture both fabric filters and ESP's.

- Better coordination between manufacturer and customer

Other recommendations included:

- Orderly planning and construction of utilities
- Need for government definition of new emission regulations.
- Avoidance of artificial material shortages.
- Equipment purchase determined by quality, not price.
- Avoidance of changes in design, specifications or operation after the contract has been signed.